

AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph beginning at page 1, lines 11-19 with the following rewritten paragraph:

SMPS converters are very versatile. They can be used, for example, to:

1. step down an unregulated dc input voltage to produce a regulated dc output voltage using a circuit known as Buck Converter or Step-Down SMPS,
2. step up an unregulated dc input voltage to produce a regulated dc output voltage using a circuit known as Boost converter ~~to~~ or Step-Up SMPS,
3. step up or step down an unregulated dc input voltage to produce a regulated dc output voltage using a Buck-Boost Converter.

Please replace the paragraph beginning at page 2, lines 4-7, with the following rewritten paragraph:

Whether a converter is a flyback converter, a forward converter or a combined forward-flyback converter, it is necessary to provide a primary bias circuit for the controller which controls the switching cycle and also to provide a primary clamp circuit.

Please replace the paragraph beginning at page 3, lines 1-12 with the following rewritten paragraph:

According to the invention, the converter may include a transformer having a primary winding, a secondary winding and an auxiliary winding, a first switching device for connecting an input voltage to the primary winding of the transformer, an output circuit connected to the secondary winding, a controller, and an integrated active clamp and primary bias. The integrated active clamp and primary bias circuit includes the auxiliary winding and a second switch for providing a bias voltage to the controller to alternately operate the first and second switches between conductive and non-conductive states such that when the first switch is conductive the second switch is nonconducting and power is transferred from the primary winding to the output circuit via the secondary winding and from the auxiliary winding to the controller and, when the

first switch is nonconducting, the second switch is conducting to provide voltage clamping of the primary winding via the second switch and the auxiliary winding.

Please replace the paragraph beginning at page 4, lines 16-26 with the following rewritten paragraph:

FIG.1 shows the circuit diagram of a conventional forward converter with an active clamp circuit. As shown, a DC voltage at the input is connected to the primary winding N_p of a transformer T1 via a main power switch S1. The conventional active clamp circuit is formed by an auxiliary switch S2 and a capacitor C1 in parallel with an auxiliary winding N_b of the transformer T1. The conventional forward converter also includes a separate primary bias circuit comprising an auxiliary winding N_a of the transformer T1 connected to a ~~rectified~~ rectifier diode D1, a freewheeling diode D2, and an LC filter comprising an inductor L1 and a capacitor C2. The secondary winding N_s of the transformer T1 is connected to an output load through an output filter comprising inductor L_o , capacitor C_o and a synchronous rectifier including switches S3 and S4.

Please replace the paragraph beginning at page 5, lines 1-11, with the following rewritten paragraph:

In a forward converter as shown in FIG. 1, the switching waveforms of which are shown in Fig. 2, when power switch S1 is conducting, auxiliary switch S2 is off and energy is ~~transformer T1~~ is transferred via the secondary winding N_s of the transformer T1 to the output load and is transferred via the auxiliary winding N_a to the primary bias circuit. During this period, diode D1 conducts to transfer energy to the control circuit 10 and store energy in filter inductor L1. During the off period of S1, auxiliary switch S2 is turned on to reset transformer T1, while the control circuit 10 is biased with the energy stored in inductor L1 through D2. Accordingly, reset of transformer T1 is effected by the separate active clamp circuit comprising auxiliary switch S2, capacitor C1 and auxiliary winding N_b . As a result, an average bias voltage for the control circuit 10 is formed separately in the conventional forward converter of Fig. 1.

Please replace the paragraph beginning at page 6, lines 4-7, with the following rewritten paragraph:

FIG. 5 illustrates an application of the novel combination of an integrated clamp circuit with a primary bias circuit of the present invention applied to a flyback converter having a flyback transformer T1, and FIG. 6 illustrates the switching waveforms occurring in the converter illustrated in FIG. 5.

Please replace the paragraph beginning at page 6, lines 8-20, with the following rewritten paragraph:

In operation, the power switch S1 and the active clamp switch S2 are turned on and off alternately by the control circuit 10. During $[t_0, t_1]$ (Fig. 6), power switch S1 is on and winding Nc is positively biased, i.e., the dot end of winding Nc is positive compared to the non-dot end. The active clamp switch S2 is off during this period with a voltage stress as ~~show~~ shown in FIG. 6. At time t_1 , S1 is turned off. The energy stored in transformer T1 during the conduction of S1 is transferred to the control circuit 10 and the voltage spike (not shown) on S1 due to the leakage inductance between primary and secondary windings is clamped via the capacitor C1, auxiliary winding Nc and the switch S2. S2 is still turned on during the turn-off of S1 as a part of the bias circuit. As seen, the auxiliary winding Nc is a common part of both the active clamp circuit and the primary bias circuit. The selection of the number of winding turns of the auxiliary winding Nc is determined by the bias voltage the control circuit requires.

Please replace the paragraph beginning at page 6, lines 22-25, with the following rewritten paragraph:

FIG. 7 illustrates an application of the novel combination of an active clamp circuit with a primary bias circuit of the present invention applied to forward-flyback converter having a flyback transformer T1, and FIG. 8 illustrates the switching waveforms occurring in the converter illustrated in FIG. 7.

Please replace the paragraph beginning at page6, lines 22-25, with the following rewritten paragraph:

As described above, in converters incorporating an integrated active clamp circuit with a primary bias circuit, an auxiliary winding (e.g., the winding Nb) is omitted. This enables an increase in the power density of DC-DC converters. This is because the ever-increasing demand in power density requirements for isolated DC-DC converters, has made it common for a PCB (Printed Circuit Board) transformer to be used instead of using a traditional transformer with several windings mounted on a bobbin. However, if a PCB transformer contains too many windings, it will require an expensive multi-layer PCB and a considerable number of terminal connections. This makes it difficult to achieve a high power density. By saving an auxiliary winding, as in the present invention, it is much easier to design a PCB transformer with fewer windings to satisfy the desire for high power density.